RESINTECH INC
INNOVATIONS IN ION EXCHANGE

TECHNICAL DATA SHEET

RADWASTE DECONTAMINATION FACTOR

The degree of column utilization defined as the ratio of the breakthrough capacity to the total capacity is often employed to express the efficiency with which the ion exchange column has been used. The steeper the breakthrough curve (a plot of time or the cumulative effluent volume versus the ratio of the concentration of a component in the effluent, CE to the concentration of the same component in the feed CF) the higher is the degree of column utilization. The reciprocal of the fractional breakthrough is defined as the instantaneous decontamination factor or DF. DF is high early in the life of the bed and becomes lower as breakthrough is approached. The ratio of the total activity of a component in the cumulative feed to the total activity of the component in the cumulative effluent is defined as the time (or volume) average DF. The activities are considered normalized to a specified decay time. In other words, the time average DF is given by the expression DF equals AF divided by AE where AF equals feed and AE equals effluent.

$$DF = \frac{AF}{AE} \quad \text{Where } AF = \text{Feed and } AE = AE$$

The DF is used to characterize the performance of an ion exchange system and is governed by the operating conditions as well as the properties of the ion exchange material.

The majority of plants use a DF based on gross ratio activity to represent system performance. The DF's for ion exchange systems in power plants, especially for the primary cooling system, fluctuate considerably due to the wide variation of pH and the accompanying variation in a composition.

DF for a mixed bed unit can shift from about 300 at pH 10.5 to 5 at pH 4.5 with the primary coolant containing approximately 900 ppm of boron. The DF for the same unit at pH 7 was in the range of 100 to 200.

Taken from: The Use Of Ion Exchange For The Treatment Of Liquids In Nuclear Power Plants, by K.H. Lin, Oakridge National Laboratory.

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